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YELLOWSTONE RIVER COMPACT COMMISSION

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TWENTY-FOURTH ANNUAL REPORT

1975

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TWENTY-FOURTH ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1975

YELLOWSTONE RIVER COMPACT COMMISSION

421 Federal Building
Helena, Montana

Honorable Ed Herschler
Governor of the State of Wyoming
Cheyenne, Wyoming

Honorable Thomas L. Judge
Governor of the State of Montana
Helena, Montana

Honorable Arthur A. Link
Governor of the State of North Dakota
Bismarck, North Dakota

Sirs:

Pursuant to Article III of the Yellowstone River Compact, the Commission submits the following twenty-fourth annual report of activities for the period ending September 30, 1975.

The commission held a special meeting at Sheridan, Wyoming on November 12, 1975. Mr. George L. Christopulos, Wyoming State Engineer, Mr. Orrin Ferris, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, the designated representatives of their respective states, and Mr. Walter R. Scott, the designated Federal representative and chairman, were all present.

Others present were:

William Long, Deputy Wyoming State Engineer,
Cheyenne, Wyoming,
James H. Barrett, Assistant Attorney General,
State of Wyoming, Cheyenne, Wyoming,
Paul Kawulok, Wyoming Board of Control,
Sheridan, Wyoming,
Ted J. Doney, Attorney, Montana Department of Natural
Resources and Conservation, Helena, Montana,
Gary Fritz, Montana Department of Natural Resources
and Conservation, Helena, Montana,
Rick Bondy, Montana Department of Natural Resources
and Conservation, Helena, Montana,
George M. Pike, U.S. Geological Survey, Helena,
Montana,
Betty L. Dean, U.S. Geological Survey, Compact
Stenographer, Helena, Montana.

This special meeting was called to initiate discussions of water-right procedures in Montana and Wyoming and definition of terms in the Compact. This is considered a first step toward the development of a model of the Yellowstone River.

The Commission held the annual meeting at Sheridan, Wyoming on November 13, 1975. Mr. George L. Christopoulos, Wyoming State Engineer, Mr. Orrin Ferris, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, the designated representatives of their respective states, and Mr. Walter R. Scott, the designated Federal representative and chairman, were all present.

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Resources and Conservation, Helena, Montana,
Gary Fritz, Montana Department of Natural Resources
and Conservation, Helena, Montana,
Rick Bondy, Montana Department of Natural Resources
and Conservation, Helena, Montana,
Murray G. Sagsveen, Assistant Attorney General,
State of North Dakota, Bismarck, North Dakota,
Paul H. Shore, Missouri River Basin Commission,
Cody, Wyoming,
Phil Q. Gibbs, U.S. Bureau of Reclamation,
Billings, Montana,
Alvin E. Bielefeld, Field Solicitor, Department
of the Interior, Billings, Montana,
George M. Pike, U.S. Geological Survey, Helena,
Montana,
Betty L. Dean, U.S. Geological Survey, Compact
Stenographer, Helena, Montana.

There were no incidents during the year that required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission feels that a program of intensive water-use regulations is not necessary. However, the attention of the Commission is focused on the need to define detailed procedures for implementing Compact provisions previous to the time when development of water within the Yellowstone River Basin requires that these provisions be enforced.

The interest in Yellowstone River water for coal development and peripheral needs has continued to increase and it is evident that, at some yet undetermined time, it will be necessary to divide the waters of the Yellowstone River System as allocated by Article V of the Compact.

The documentation of pre-1950 water rights has been completed in Wyoming. The new 1973 Montana Water Code is assisting that state in its documentation, although it is still incomplete.

A problem that continues to be of major long-range concern to the Commission is the uncertainty of the quantity of water to be used by Indians from those streams flowing through Indian reservations. The Commission believes that studies and action necessary to the quantification of Indian needs and rights should be expedited.

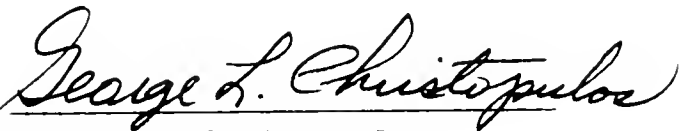
Intake Water Company filed suit against the Commission and its members in Federal District Court in Billings, Montana, on June 29, 1973, which was discussed in the twenty-second annual report. Since then the Montana Department of Natural Resources and Conservation has brought suit in state court to invalidate any water right that the Intake Water Company purported to hold for Yellowstone River waters. This trial is to begin on November 18, 1975, with a ruling expected sometime after December 20, 1975. The Federal District Judge has stayed the Federal action until it is determined whether the Intake Water Company actually has a water right. If the Company does not have a water right, the suit against the Commission would be dismissed.

One change was made in Commission membership during 1975. On April 4, 1975, Mr. George L. Christopulos, Wyoming State Engineer, was appointed by Governor Ed Herschler to succeed Mr. Floyd A. Bishop, who retired.

The Commission feels that due to the potential for large-scale use of water associated with coal development, joint allocation and development studies should be carried out in the near future. To this end special meetings, conducted as work sessions, will be scheduled to continue to document understandings and to develop procedures for implementation of Article V of the Compact.

The budgets for fiscal years 1976 through 1977 are discussed in the following general report. The amount of funds required for future Commission activities will depend largely on the outcome of water-development plans, inflation, and the degree of water administration required.

Respectfully submitted,



George L. Christopulos
Commissioner for Wyoming



Orrin Ferris
Commissioner for Montana



Walter R. Scott
Federal Representative

GENERAL REPORT

Cost:

The work funded by the Commission, which to date has been primarily concerned with the collection of required hydrologic data, has been financed through cooperative arrangements whereby Montana and Wyoming each bear one-fourth of the cost and the remaining one-half is borne by the United States. The salaries and necessary expenses of the State and Federal representatives, and hydrologic data made available by other agencies, are not evaluated or considered as expenses of the Commission.

The expense of the Commission during Fiscal Year 1975 was \$16,480, in accordance with the budget adopted for the year.

The budgets for Fiscal Years 1976 and 1977 were tentatively adopted subject to the availability of appropriations.

The budgets for the three fiscal years are summarized as follows:

July 1, 1975 to June 30, 1976 (Fiscal Year 1976):

Continuation of existing stream-gaging program	\$19,700
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July 1, 1976 to September 30, 1976 (Transition quarter):^{1/}

Continuation of existing stream-gaging program	4,900
--	-------

October 1, 1976 to September 30, 1977 (Fiscal Year 1977):

Estimate for continuation of existing stream-gaging program	21,200
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Gaging Stations:

Gaging stations at the measuring sites specified in the Compact were continued in operation and satisfactory discharge records collected at each. In addition, a station on Prairie Dog Creek near the Montana-Wyoming State line was operated for Compact administration purposes. Locations of gaging and reservoir stations are shown on a map of the Yellowstone River basin at the end of the report.

^{1/} The Federal fiscal year will change to run from 10/1/76 to 9/30/77, and the 3-month period is necessary to accomplish the shift.

During the Water Year ending September 30, 1975, annual streamflow at the designated points of measurement in Montana was slightly above average except in the Powder River basin and Tongue River basin where the flow was 131 and 216 percent of average respectively.

Water stored in the mountain snowpack was considerably above average at the beginning of spring and a consequent high runoff occurred.

Details of streamflow for Water Year 1975 and bar graphs showing comparisons with average flows during selected base periods and with the preceding year are given in Appendix B.

Diversions:

There were no incidents during the year that required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission feels that a program of intensive water-use regulations is not necessary.

Storage:

In reservoirs completed after January 1, 1950

Bighorn Lake, a U.S. Bureau of Reclamation project on the Bighorn River, and the largest storage project in the basin, contained 1,056,000 acre-feet at the beginning of the year and 1,018,000 acre-feet at the close. It fluctuated from a minimum of 734,600 acre-feet on March 31, 1975, to a maximum of 1,191,000 acre-feet on July 26, 1975. Boysen Reservoir, located on the Wind River and operated by the U.S. Bureau of Reclamation, began the year with 633,700 acre-feet in storage and ended with 662,900 acre-feet. Details regarding these reservoirs are given in Appendix C. The Commission is cognizant of other reservoirs in this general group and considers their aggregate effect to be insufficient to warrant the collection of storage data at this time.

In reservoirs existing on January 1, 1950

As a matter of record and general information, month-end storage data are given in Appendix D for reservoirs in existence above the points of measurement on January 1, 1950. These data are pertinent to allocation under Article V, Section C, Item 5 of the Compact.

RULES AND REGULATIONS FOR ADMINISTRATION OF
THE YELLOWSTONE RIVER COMPACT

A compact, known as the Yellowstone River Compact, between the States of Wyoming, Montana and North Dakota, having become effective on October 30, 1951 upon approval of the Congress of the United States, which apportions the waters of certain interstate tributaries of the Yellowstone River which are available after the appropriative rights existing in the States of Wyoming and Montana on January 1, 1950 are supplied, and after appropriative rights to the use of necessary supplemental water are also supplied as specified in the Compact, the following rules and regulations are adopted subject to the provisions for amendment, revision or abrogation as provided herein.

Article I. Collection of Water Records

- A. It shall be the joint and equal responsibility of the members of the states of Wyoming and Montana to collect, cause to be collected or otherwise furnish records of tributary stream flow at the points of measurement specified in Article V (B) of the Compact, or as near thereto as is physically or economically feasible or justified.

1. Clarks Fork

The gaging station known as Clarks Fork near Silesia, Montana and located in NE 1/4 SE 1/4 sec.1, T.4 S., R.23 E., shall be the point of measurement for the Clarks Fork.

2. Bighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River at Bighorn, Montana and located in NE 1/4 NE 1/4 sec.33, T.5 N., R.34 E., shall temporarily be the designated point of measurement on that stream. The flow of the Little Bighorn River as measured at the gaging station near Hardin, Montana, and located in NE 1/4 NE 1/4 sec.19, T.1 S., R.34 E., shall be considered the point of measurement for that stream, except that if or when satisfactory records are not available, the records for the nearest upstream station with practical corrections for intervening inflow or diversion shall be used.

3. Tongue River

The gaging station known as the Tongue River at Miles City, Montana and located in SE 1/4, sec.23, T.7 N., R.47 E., shall temporarily be the point of measurement for that stream.

4. Powder River

The gaging station known as the Powder River near Locate, Montana and located in SW 1/4 sec.14, T.8 N., R.51 E., shall temporarily be the designated point of measurement for that stream.

- B. Records of total annual diversion in acre-feet above the points of measurement designated in the Compact for irrigation, municipal and industrial uses developed after January 1, 1950, shall be furnished by the members of the Commission for their respective states, at such time as the Commission deems necessary for interstate administration as provided by the terms of the Compact. Providing that if it be acceptable to the Commission, reasonable estimates thereof may be substituted.
- C. Annual records of the net change in storage in all reservoirs, not excluded under Article V (E) of the Compact, above the point of measurement specified in the Compact and completed after January 1, 1950, and the annual net change in reservoirs existing prior to January 1, 1950, which is used for irrigation, municipal and industrial purposes developed after January 1, 1950, shall be the primary responsibility of the member of the Commission in whose state such works are located; providing such data is not furnished by federal agencies under the provisions of Article III (D) of the Compact, or collected by the Commission.

Article II. Office and Officers

- A. The office of the Commission shall be located, and be that of the United States Geological Survey, in Helena, Montana.
- B. The Chairman of the Commission shall be the federal representative as provided in the Compact.
- C. The Secretary of the Commission shall be as provided for in Article III of these rules.
- D. The credentials of each member of the Commission shall be placed on file in the office of the Commission.

Article III. Secretary

- A. The Commission, subject to the approval of the Director of the United States Geological Survey, shall enter into cooperative agreements with the U.S. Geological Survey for such engineering and clerical services as may reasonably be necessary for the administration of the Compact. Said agreements shall provide that the Geological Survey shall:
 - 1. Maintain and operate gaging stations at or near the points of measurement specified in Article V (A) of the Compact.
 - 2. Assemble factual information on stream flow, diversion and reservoir storage for the preparation of an annual report to the Governors of the signatory states.
 - 3. Make such investigations and reports as may be requested by the Commission in aid of its administration of the Compact.
- B. Act as Secretary to the Commission.

Article IV. Budget

- A. At the annual meeting of each even numbered year or prior thereto, the Commission shall adopt a budget for operation during the ensuing biennium beginning July first. Such budget shall set forth the total cost of construction, maintenance and operation of gaging stations, the cost of engineering and clerical aid, and other necessary expenses excepting the salaries and personal expenses of the Commissioners. On odd-numbered years revisions of the budget shall be considered.
- B. It shall be the obligation of the Commissioners of the states of Montana and Wyoming to endeavor to secure from the Legislature of their respective states sufficient funds with which to meet the obligations of this Compact, except insofar as provided by the federal government.

Article V. Meetings

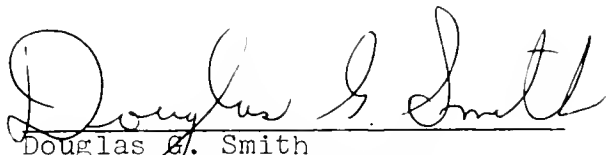
An annual meeting of the Commission shall be held each November at some mutually agreeable point in the Yellowstone River basin for consideration of the annual report for the water year ending the preceding September 30th, and for the transaction of such other business consistent with its authority; provided that by unanimous consent of the Commission the


date and place of the annual meeting may be changed. Other meetings as may be deemed necessary shall be held at a time and place set by mutual agreement, for the transaction of any business consistent with its authority.

No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

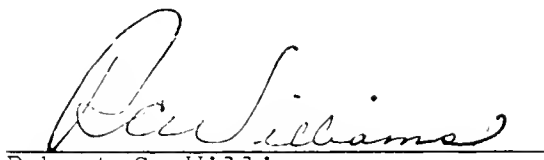
Article VI. Amendments, Revisions and Abrogations.

The Rules and Regulations of the Commission may be amended or revised by a unanimous vote at any meeting of the Commission.


Douglas E. Smith
Commissioner for Montana


Floyd A. Bishop
Commissioner for Wyoming

ATTESTED:


Robert C. Williams
Federal Representative

Adopted November 17, 1953
Amended November 9, 1970

Table 5.--*Factors for converting English units to metric units*
(International System (SI) units)

The following factors may be used to convert the English units published herein to metric units. Subsequent reports will contain both the English and metric unit equivalents in the station manuscript descriptions until such time that all data will be published in metric units.

Multiply English units	By	To obtain metric units
<i>Length</i>		
inch (in.)	2.54	centimetre (cm)
	25.4	millimetre (mm)
	.0254	metre (m)
foot (ft)	.3048	metre (m)
yard (yd)	.9144	metre (m)
rod	5.0292	metre (m)
mile (mi)	1.609	kilometre (km)
<i>Area</i>		
acre	4047	square metre (m ²)
	.4047	*hectare (ha)
	.4047	square hectometre (hm ²)
	.004047	square kilometre (km ²)
square mile (mi ²)	2.590	square kilometre (km ²)
<i>Volume</i>		
gallon (gal)	3.785	**litre (l)
	3.785	cubic decimetre (dm ³)
	3.785×10 ⁻³	cubic metre (m ³)
million gallons (10 ⁶ gal)	3785	cubic metre (m ³)
	3.785×10 ⁻³	cubic hectometre (hm ³)
cubic foot (ft ³)	28.32	cubic decimetre (dm ³)
	.02832	cubic metre (m ³)
cubic foot per second-day (ft ³ /s-day)	2447	cubic metre (m ³)
	2.447×10 ⁻³	cubic hectometre (hm ³)
acre-foot (acre-ft)	1233	cubic metre (m ³)
	1.233×10 ⁻³	cubic hectometre (hm ³)
	1.233×10 ⁻⁶	cubic kilometre (km ³)
<i>Flow</i>		
cubic foot per second (ft ³ /s)	28.32	litre per second (l/s)
	28.32	cubic decimetre per second (dm ³ /s)
	.02832	cubic metre per second (m ³ /s)
gallon per minute (gpm)	.06309	litre per second (l/s)
	.06309	cubic decimetre per second (dm ³ /s)
	6.309×10 ⁻⁵	cubic metre per second (m ³ /s)
million gallons per day (mgd)	43.81	cubic decimetre per second (dm ³ /s)
	.04381	cubic metre per second (m ³ /s)
<i>Mass</i>		
ton (short)	907.2	kilogram (kg)
	.9072	tonne (t)

*The unit hectare is approved for use with the International System (SI) for a limited time. See NBS Special Bulletin 330, p. 15, 1972 edition.

**The unit litre is accepted for use with the International System (SI). See NBS Special Bulletin 330, p. 13, 1972 edition.

MONTHLY SUMMARY OF DISCHARGE

Clarks Fork Yellowstone River near Silesia, Montana

LOCATION.--Lat 45°30'48", long 108°49'41", in NE¼SE¼ sec.1, T.4 S., R.23 E., Carbon County, on left bank 0.5 mi (0.8 km) downstream from Whitehorse Canal intake, 1 mi (1.6 km) upstream from Rock Creek, 3 mi (4.8 km) south of Silesia, and at mile 19 (30.6 km).

DRAINAGE AREA.--2,093 mi² (5,421 km²).

PERIOD OF RECORD.--October 1969 to September 1975. Records for July 1921 to September 1969 (published as Clarks Fork Yellowstone River at Edgar) at site 5 mi (8.0 km) upstream not equivalent owing to diversion in Whitehorse Canal during irrigation season. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 3,410 ft (1,039 m), from topographic map.

AVERAGE DISCHARGE.--6 years (1970-75), 1,273 ft³/s (36.1 m³/s), 922,300 acre-ft/yr (1.14 km³/yr).

EXTREMES.--Current year: Maximum discharge, 11,300 ft³/s (320 m³/s) July 6, gage height, 7.82 ft (2.384 m); minimum daily, 180 ft³/s (5.10 m³/s) Feb. 5-9.

Period of record: Maximum discharge, 11,800 ft³/s (334 m³/s) June 10, 1972, gage height, 7.51 ft (2.289 m); maximum gage height, 7.82 ft (2.384 m) July 6, 1975; minimum daily, 140 ft³/s (3.96 m³/s) Dec. 4, 1972.

REMARKS.--Records good except those for winter period, which are poor. Diversion for irrigation of about 42,600 acres (172 km²) of which 1,100 acres (4.45 km²) lies below station. In addition, about 9,000 acres (36.4 km²) of land above station are irrigated by diversions from the adjoining Rock Creek basin.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>
October 1974	15,113	1,130	393	488	29,980
November	16,752	1,070	472	558	33,230
December	13,619	565	200	439	27,010
January 1975	9,035	500	195	291	17,920
February	9,790	700	180	350	19,420
March	15,964	820	240	515	31,660
April	15,385	754	364	513	30,520
May	50,644	3,140	424	1,634	100,500
June	128,830	6,380	2,090	4,294	255,500
July	173,730	10,100	2,220	5,604	344,600
August	35,046	2,960	568	1,131	69,510
September 1975	<u>15,945</u>	697	441	532	<u>31,630</u>
Water Year 1974-75	499,853	10,100	180	1,369	991,500

CLARKS FORK YELLOWSTONE RIVER NEAR SILESIA, MONT.
(Replaces Clarks Fork Yellowstone River at Edgar)

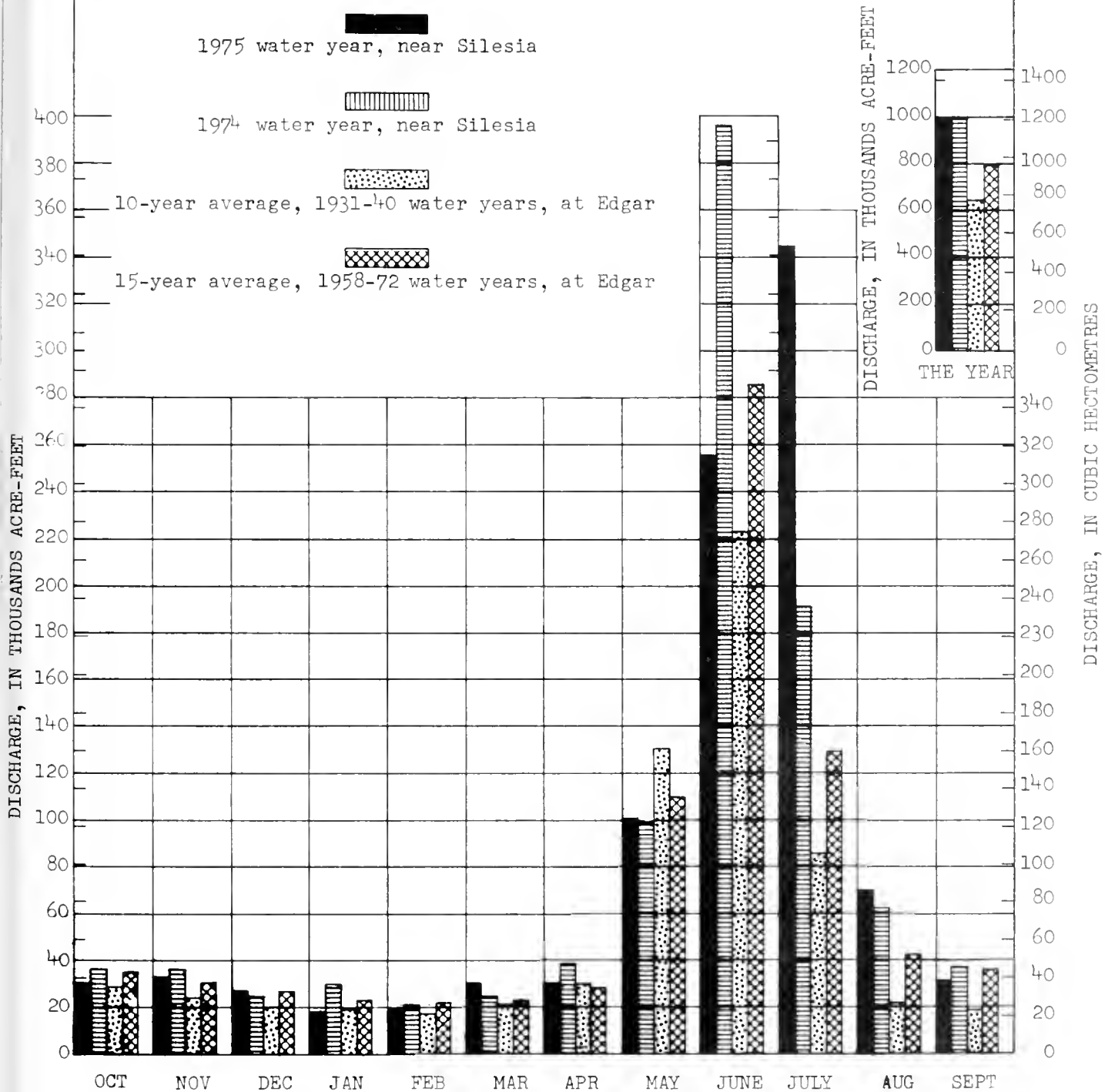
EXPLANATION

1975 water year, near Silesia

1974 water year, near Silesia

10-year average, 1931-40 water years, at Edgar

15-year average, 1958-72 water years, at Edgar



Comparison of discharge during 1975 water year with 1974 water year, near Silesia and with average discharge for the water years 1931-40 and 1958-72 at Edgar.

MONTHLY SUMMARY OF DISCHARGE

Little Bighorn River near Hardin, Montana

LOCATION.--Lat 45°44'08", long 107°33'27", in NE¼NE¼ sec.19, T.1 S., R.34 E., Big Horn County, on left bank 50 ft (15 m) downstream from bridge on Sarpy Road, 0.2 mi (0.3 km) upstream from terminal wasteway of Agency Canal, 0.6 mi (1.0 km) upstream from mouth, and 2.3 mi (3.7 km) east of Hardin.

DRAINAGE AREA.--1,294 mi² (3,351 km²).

PERIOD OF RECORD.--June 1953 to September 1975.

GAGE.--Water-stage recorder. Altitude of gage is 2,890 ft (881 m), from topographic map. Prior to Oct. 7, 1953, nonrecording gage at site 0.4 mi (0.6 km) downstream. Oct. 7, 1953, to May 6, 1963, water-stage recorder at site 0.3 mi (0.5 km) downstream. May 6, 1963, to Nov. 6, 1963, nonrecording gage at site 0.4 mi (0.6 km) downstream. All at different datums.

AVERAGE DISCHARGE.--22 years, 311 ft³/s (8.81 m³/s), 225,300 acre-ft/yr (278 hm³/yr).

EXTREMES.--Current year: Maximum discharge, 4,040 ft³/s (114 m³/s) May 9, gage height 6.52 ft (1.987 m), from graph based on gage readings; maximum gage height, 10.25 ft (3.124 m) Jan. 19 (backwater from ice); minimum daily discharge, 40 ft³/s (1.13 m³/s) Feb. 1.

Period of record: Maximum discharge, 4,520 ft³/s (128 m³/s) Apr. 2, 1965; maximum gage height, 11.78 ft (3.591 m) Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.20 ft³/s (0.006 m³/s) Aug. 7, 1961, result of discharge measurement.

REMARKS.--Records good except those for winter period, which are poor. Flow partly regulated by Willow Creek Reservoir (capacity, 23,000 acre-ft, 28.4 hm³). Diversions for irrigation of about 17,000 acres (68.8 km²) above station. Figures of discharge given herein include flow of terminal wasteway of Agency Canal.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1974	6,157	301	159	199	12,210
November	7,416	671	123	247	14,710
December	6,235	260	131	201	12,370
January 1975	11,336	1,200	45	366	22,480
February	8,075	520	40	288	16,020
March	24,297	2,670	152	784	48,190
April	17,362	1,140	162	579	34,440
May	47,508	3,840	710	1,533	94,230
June	58,510	2,610	1,030	1,950	116,100
July	41,327	2,440	521	1,333	81,970
August	11,830	561	250	382	23,460
September 1975	6,621	282	180	221	13,130
Water year 1974-75	246,674	3,840	40	676	489,300

MONTHLY SUMMARY OF DISCHARGE

Bighorn River at Bighorn, Montana

LOCATION.--Lat 46°08'50", long 107°28'00", in NE¼NE¼ sec.33, T.5 N., R.34 E., Treasure County, on right bank just downstream from bridge on old U.S. Highway 10, 0.3 mi (0.5 km) downstream from bridge on Interstate Highway 94, 0.7 mi (1.1 km) upstream from mouth, 1.3 mi (2.1 km) southwest of Bighorn, and 4.4 mi (7.1 km) east of Custer.

DRAINAGE AREA.--22,885 mi² (59,272 km²). Area at site used prior to Oct. 7, 1955, 22,410 mi² (58,042 km²).

PERIOD OF RECORD.--May 1945 to September 1975. Published as "near Custer", 1945-55. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,690 ft (820 m), by barometer. May 11 to Dec. 6, 1945, nonrecording gage, and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 mi (6.4 km) upstream at different datum.

AVERAGE DISCHARGE.--30 years, 3,953 ft³/s (111.9 m³/s), 2,864,000 acre-ft/yr (3.53 km³/yr), unadjusted.

EXTREMES.--Current year: Maximum discharge, 12,400 ft³/s (351 m³/s) May 8; maximum gage height, 8.65 ft (2.637 m) Feb. 8 (backwater from ice); minimum discharge, 2,170 ft³/s (61.5 m³/s) Nov. 3.

Period of record: Maximum discharge, 26,200 ft³/s (742 m³/s) June 24, 1947, gage height, 8.79 ft (2.679 m), site and datum then in use, from rating curve extended above 12,500 ft³/s (354 m³/s); maximum gage height recorded, 14.21 ft (4.331 m) Apr. 2, 1965 (ice jam); minimum discharge, about 275 ft³/s (7.79 m³/s) Nov. 15, 1959, result of freezeup; minimum daily, 400 ft³/s (11.3 m³/s) Apr. 4, 1967.

REMARKS.--Records good except those for period of backwater from Yellowstone River (May 13 to Aug. 16), which are fair. Flow regulated by Bighorn Lake beginning November 1965 (usable capacity, 1,356,000 acre-ft, 1.67 km³). Major regulation prior to November 1965 by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft, 1.73 km³ (see Appendixes C and D). Diversions for irrigation of about 465,000 acres (1,880 km²) above station.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet	Adjusted runoff in acre-feet*
Oct. 1974	121,550	5,580	2,880	3,921	241,100	211,100
Nov.	131,330	8,140	2,570	4,378	260,500	210,700
Dec.	124,960	4,240	2,650	4,031	247,900	180,900
Jan. 1975	142,900	7,370	3,700	4,610	283,400	200,700
Feb.	97,500	4,500	3,000	3,482	193,400	125,300
Mar.	149,760	7,770	3,500	4,831	297,000	273,600
Apr.	134,510	5,550	2,880	4,484	266,800	278,100
May	245,440	11,800	5,100	7,917	486,800	560,600
June	267,650	10,700	7,240	8,922	530,900	667,200
July	262,010	10,900	7,420	8,452	519,700	742,300
Aug.	182,700	8,350	5,150	5,894	362,400	244,400
Sept. 1975	116,300	4,800	3,070	3,877	230,700	187,700
Water year						
1974-75	1,976,610	11,800	2,570	5,415	3,921,000	3,883,000

*Adjusted for change in contents in Bighorn Lake.

BIGHORN RIVER AT BIGHORN, MONT.
ADJUSTED FOR CHANGE IN CONTENTS IN BIGHORN LAKE
MINUS
LITTLE BIGHORN RIVER NEAR HARDIN, MONT.

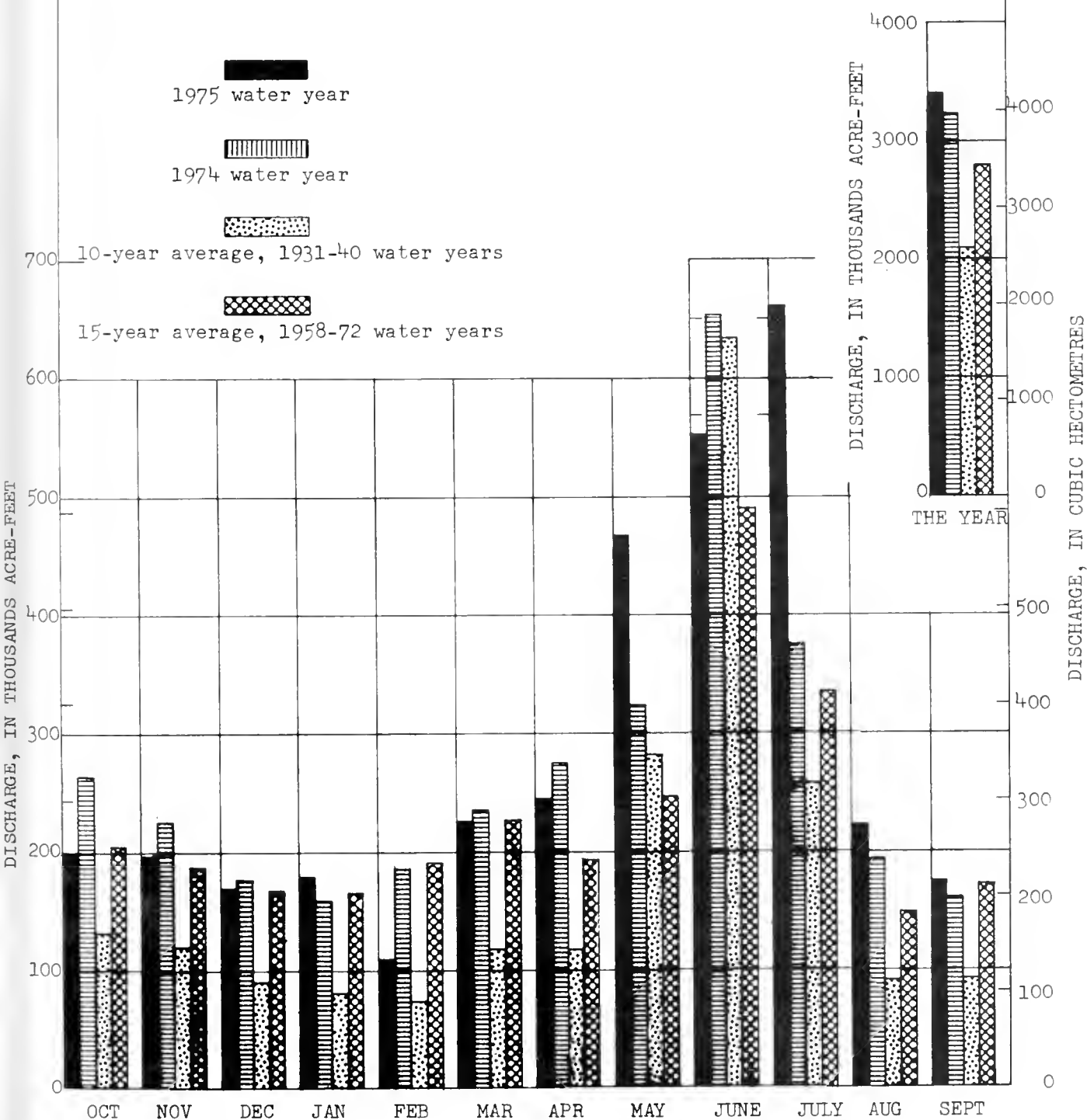
EXPLANATION

1975 water year

1974 water year

10-year average, 1931-40 water years

15-year average, 1958-72 water years



Comparison of discharge during 1975 water year with 1974 water year and with average discharge for water years 1931-40 and 1958-72.

Appendix B

MONTHLY SUMMARY OF DISCHARGE

Prairie Dog Creek near Acme, Wyoming

LOCATION.--Lat 44°59'02", long 106°50'21", in NE¼SW¼SW¼ sec. 23, T.58 N., R.83 W., Sheridan County, on right bank 600 ft (183 m) upstream from county bridge, 0.9 mi (1.5 km) upstream from mouth, 2.8 mi (4.5 km) downstream from Coutant Creek, and 7.6 mi (12.2 km) northeast of Acme.

DRAINAGE AREA.--358 mi² (927 km²).

PERIOD OF RECORD.--October 1970 to September 1975. Records for May 1965 to September 1970 in files of Office of Wyoming State Engineer.

GAGE.--Water-stage recorder. Altitude of gage is 3,450 ft (1,052 m), from topographic map.

AVERAGE DISCHARGE.--5 years, 45.6 ft³/s (1.29 m³/s), 33,040 acre-ft/yr (40.7 m³/yr).

EXTREMES.--Current year: Maximum discharge, 738 ft³/s (20.9 m³/s) Mar. 5, gage height, 6.01 ft (1.832 m), from rating curve extended above 190 ft³/s (5.38 m³/s) on basis of step-backwater computation; minimum daily, 8.0 ft³/s (0.23 m³/s) Feb. 8.

Period of record: Maximum discharge, 738 ft³/s (20.9 m³/s) Mar. 5, 1975, gage height, 6.01 ft (1.832 m), from rating curve extended above 190 ft³/s (5.38 m³/s) on basis of step-backwater computation; minimum daily, 6.6 ft³/s (0.187 m³/s) July 23, Aug. 3, 1974.

REMARKS.--Records good except those for winter period, which are fair. Diversions above station for irrigation of about 13,600 acres (55.0 km²) of which about 60 acres (243,000 m²) lies below station. Flow supplemented by 3 transbasin diversions from North Piney Creek and South Piney Creek via Prairie Dog ditch, Piney and Cruse ditch and Mead-Coffeen ditch.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>
October 1974	827	42	18	26.7	1,640
November	1,022	61	20	34.1	2,030
December	743	60	14	24.0	1,470
January 1975	417.0	24	9.0	13.5	827
February	720.0	150	8.0	25.7	1,430
March	3,845	581	25	124	7,630
April	1,946	108	38	64.9	3,860
May	2,321	209	36	74.9	4,600
June	1,794	161	17	59.8	3,560
July	1,395	66	28	45.0	2,770
August	1,177	105	16	38.0	2,330
September 1975	<u>561</u>	32	12	18.7	<u>1,110</u>
Water Year 1974-75	16,768.0	581	- 8.0	45.9	33,260

MONTHLY SUMMARY OF DISCHARGE

Tongue River at Miles City, Montana

LOCATION.--Lat 46°21'30", long 105°48'24", in SE¼ sec.23, T.7 N., R.47 E., Custer County, on right bank 4 mi (6.4 km) south of Miles City and 8 mi (12.9 km) upstream from mouth.

DRAINAGE AREA.--5,379 mi² (13,932 km²).

PERIOD OF RECORD.--April 1938 to April 1942, April 1946 to September 1975. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to October 1932. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950 available in annual report of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,370 ft (722 m), by barometer. April 1938 to April 1942, nonrecording gage at site 8 mi (12.9 km) upstream at different datum. April 1946 to Sept. 30, 1963, at datum 1.00 ft (0.30 m) higher.

AVERAGE DISCHARGE.--32 years (1938-41, 1946-75), 442 ft³/s (12.5 m³/s), 320,200 acre-ft/yr (395 hm³/yr).

EXTREMES.--Current year: Maximum discharge, 10,200 ft³/s (289 m³/s) May 7, gage height, 10.40 ft (3.170 m); minimum daily, 80 ft³/s (2.27 m³/s) Feb. 10.


Period of record: Maximum discharge, 13,300 ft³/s (377 m³/s) June 15, 1962, gage height, 12.33 ft (3.758 m), present datum, from rating curve extended above 5,200 ft³/s (147 m³/s) on basis of float measurement; maximum gage height, 13.27 ft (4.045 m), present datum, Mar. 19, 1960, Feb. 15, 1971 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.


REMARKS.--Records good except those for winter period, which are poor. Flow regulated by Tongue River Reservoir (Appendix C) and many small reservoirs in Wyoming (combined capacity, about 15,000 acre-ft, 18.5 hm³). Diversions for irrigation of about 90,000 acres (364 km²) above station.

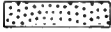
Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1974	7,189	372	136	232	14,260
November	9,144	460	210	305	18,140
December	10,050	450	160	324	19,930
January 1975	15,550	2,000	130	502	30,840
February	5,035	390	80	180	9,990
March	30,270	1,850	450	976	60,040
April	25,130	1,580	670	838	49,850
May	55,331	7,010	841	1,785	109,700
June	81,510	4,510	1,640	2,717	161,700
July	68,426	4,060	805	2,207	135,700
August	21,688	810	476	700	43,020
September	7,819	404	122	261	15,510
Water year 1974-75	337,142	7,010	80	924	668,700


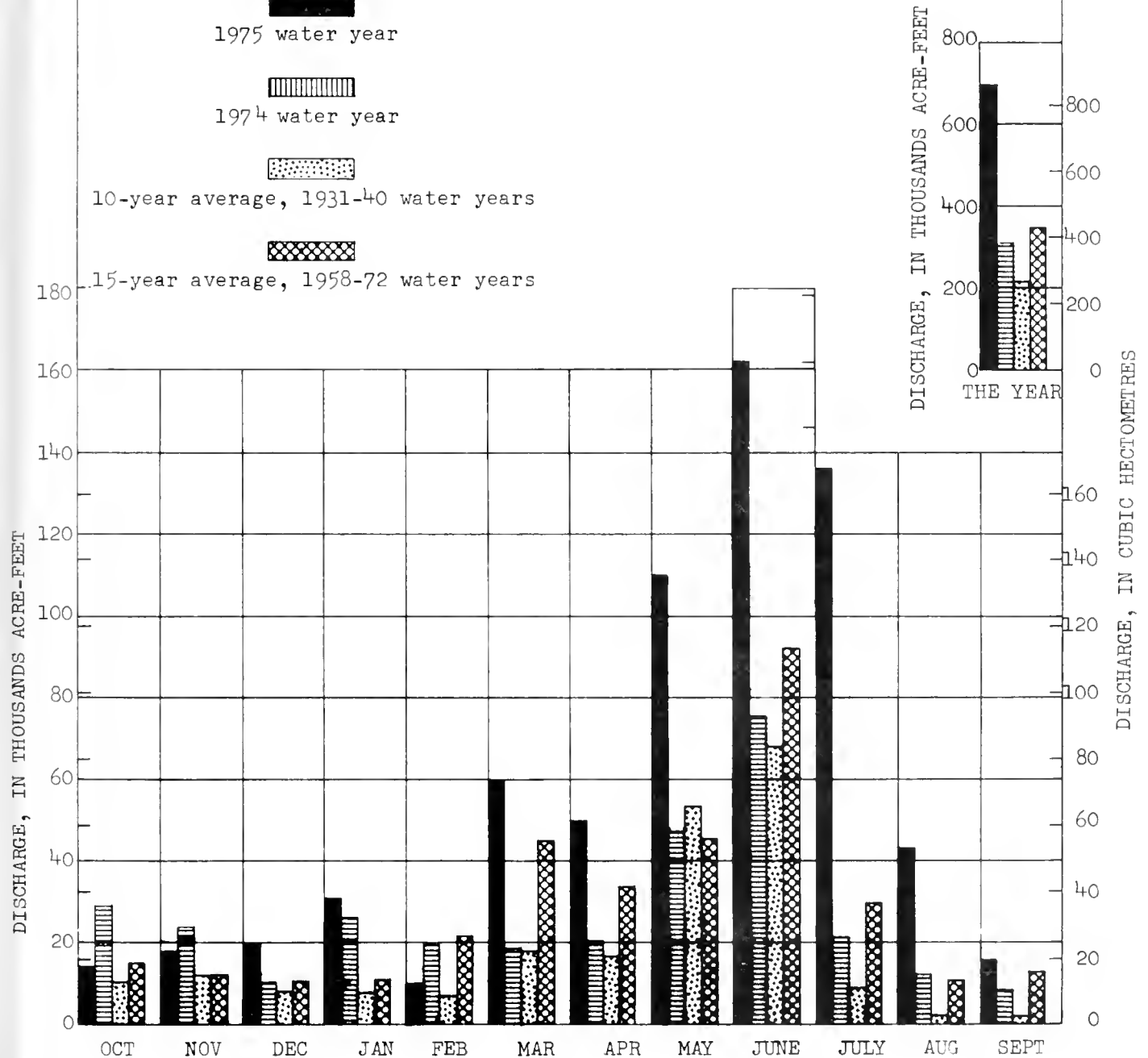
TONGUE RIVER AT MILES CITY, MONT.

EXPLANATION


 1975 water year


 1974 water year


 10-year average, 1931-40 water years


 15-year average, 1958-72 water years


Comparison of discharge during 1975 water year with 1974 water year and with average discharge for water years 1931-40 and 1958-72.

MONTHLY SUMMARY OF DISCHARGE

Powder River near Locate, Montana

LOCATION.--Lat $46^{\circ}26'56''$, long $105^{\circ}18'44''$, in NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.14, T.8 N., R.51 E., Custer County, on left bank 1.5 mi (2.4 km) downstream from bridge on U.S. Highway 12 at present site of Locate (5 mi, 8.0 km, west of former site of Locate), 1.5 mi (2.4 km) upstream from Locate Creek, and 25 mi (40 km) east of Miles City.

DRAINAGE AREA.--13,194 mi² (34,172 km²). Area at site used prior to Oct. 1, 1965, 13,189 mi² (34,160 km²).

PERIOD OF RECORD.--March 1938 to September 1975. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,390 ft (728 m), by barometer. Prior to July 11, 1947, nonrecording gage at bridge 1.5 mi (2.4 km) upstream and July 11, 1947, to Sept. 30, 1965, water-stage recorder at site near bridge at different datum. Oct. 1, 1965, to Oct. 4, 1966, nonrecording gage, and Oct. 5, 1966, to Apr. 15, 1969, water-stage recorder at site 200 ft (61 m) upstream at present datum.

AVERAGE DISCHARGE.--37 years, 622 ft³/s (17.6 m³/s), 450,600 acre-ft/yr (556 hm³/yr).

EXTREMES.--Current Year: Maximum discharge observed, 13,600 ft³/s (385 m³/s) May 7, gage height, 8.89 ft (2.710 m); minimum, 31 ft³/s (0.88 m³/s) Sept. 26, gage height, 1.38 ft (0.421 m).


Period of record: Maximum discharge observed, 31,000 ft³/s (878 m³/s) Feb. 19, 1943, gage height, 11.23 ft (3.423 m), site and datum then in use, from rating curve extended above 17,000 ft³/s (481 m³/s); no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.


REMARKS.--Records good except those for winter period, which are poor. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft (45.4 hm³). Diversions for irrigation of about 52,000 acres (210 km²).

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1974	8,088	326	188	261	16,040
November	9,649	490	200	322	19,140
December	6,315	280	80	204	12,530
January 1975	5,545	310	70	179	11,000
February	6,590	750	100	235	13,070
March	29,960	3,200	150	966	59,430
April	25,623	1,200	260	854	50,820
May	61,934	9,600	746	1,998	122,800
June	86,230	5,700	1,250	2,874	171,000
July	48,421	2,760	460	1,562	96,040
August	5,877	376	92	190	11,660
September 1975	<u>1,486</u>	87	32	49.5	<u>2,950</u>
Water year 1974-75	295,718	9,600	32	810	586,600


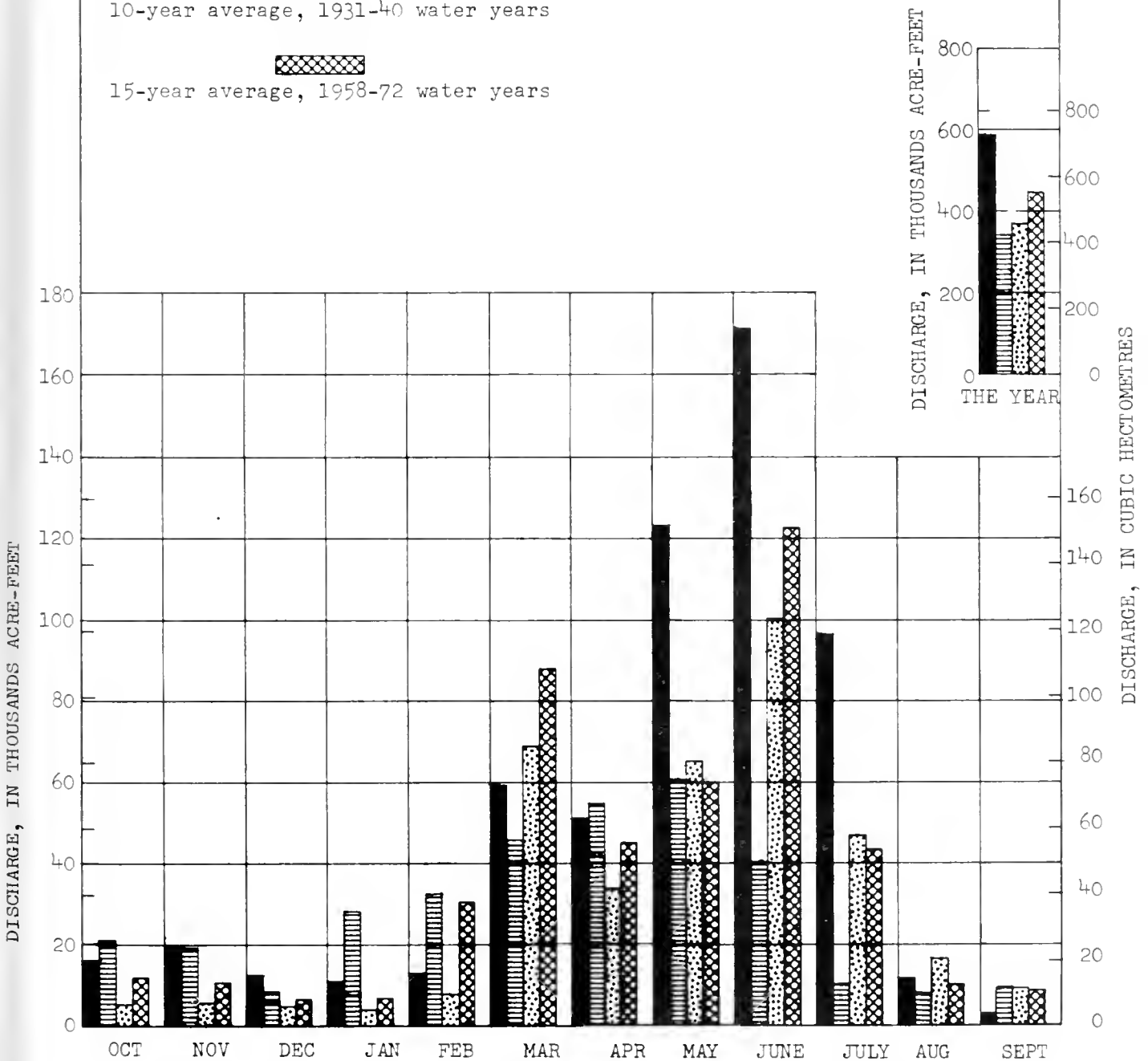
POWDER RIVER NEAR LOCATE, MONT.

EXPLANATION


 1975 water year


 1974 water year


 10-year average, 1931-40 water years


 15-year average, 1958-72 water years


Comparison of discharge for 1975 water year with 1974 water year and with average discharge for water years 1931-40 and 1958-72.

Appendix C

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

Boysen Reservoir, Wyoming

LOCATION.--Lat 43°25'00", long 108°10'37", in NW¼NW¼ sec. 16, T.5 N., R.6 E., Fremont County, at dam on Wind River, 13 mi (21 km) north of Shoshoni, Wyoming.

DRAINAGE AREA.--7,700 mi² (19,943 km²).

RECORDS AVAILABLE.--October 1951 to September 1975 (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is at mean sea level, datum of 1933 (levels by Bureau of Reclamation).

EXTREMES.--Current year: Maximum daily contents, 771,000 acre-ft (951 hm³) July 21 (elevation, 4,726.45 ft or 1,440.622 m); minimum daily, 434,300 acre-ft (535 hm³) May 13 (elevation, 4,706.51 ft or 1,434.544 m).

Period of record: Maximum daily contents, 862,500 acre-ft (1,060 hm³) July 6, 7, 1967 (elevation, 4,730.83 ft or 1,441.957 m); minimum daily (since normal use of water started), 189,800 acre-ft (234 hm³) Mar. 18, 19, 1956 (elevation, 4,684.18 ft or 1,427.738 m), capacity table then in use.

REMARKS.--Reservoir is formed by rock-fill dam completed in October 1951. Storage began Oct. 11, 1951. Usable capacity, 742,100 acre-ft (915 hm³) between elevation 4,657.00 ft (1,419.454 m), invert of penstock pipe, and 4,725.00 ft (1,440.180 m), top of spillway gate. Dead storage, 59,880 acre-ft (73.8 hm³) below elevation 4,657.00 ft (1,419.454 m). Prior to Jan. 1, 1966, usable capacity was 757,800 acre-ft (934 hm³) and dead storage was 62,000 acre-ft (76.4 hm³), at same elevations. Crest of dam is at elevation 4,758 ft (1,450 m). Figures given herein represent usable contents. Water used for irrigation, flood control, and power development.

COOPERATION.--Records furnished by Bureau of Reclamation.

	Water-surface elevation (feet)	Contents* (acre-feet)	Change in Contents (acre-feet)
September 30, 1974.	4,719.17	633,700	--
October 31.	4,718.88	628,600	- 5,100
November 30	4,718.15	615,800	- 12,800
December 31	4,714.72	558,100	- 57,700
January 31, 1975.	4,712.21	518,400	- 39,700
February 28	4,710.48	492,100	- 26,300
March 31.	4,709.82	482,200	- 9,900
April 30.	4,707.15	443,300	- 38,900
May 31.	4,708.40	461,000	+ 17,700
June 30	4,717.31	601,300	+ 140,300
July 31	4,724.89	740,000	+ 138,700
August 31	4,722.27	690,000	- 50,000
September 30, 1975.	4,720.80	662,900	- 27,100
Water year 1974-75			+ 29,200

*Does not include dead storage of 59,880 acre-ft (73.8 hm³).

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

Anchor Reservoir, Wyoming

LOCATION.--Lat 43°39'50", long 108°49'27", in sec.26, T.43 N., R.100 W., Hot Springs County, at dam on South Fork Owl Creek, 2 mi (3.2 km) downstream from Middle Fork, 3 mi (4.8 km) southeast of Anchor, and 32 mi (51 km) west of Thermopolis.

DRAINAGE AREA.--125 mi² (324 km²), approximately.

RECORDS AVAILABLE.--November 1960 to September 1975 (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is at mean sea level (Bureau of Reclamation datum).

EXTREMES.--Current year: Maximum daily contents, 8,140 acre-ft (10.0 hm³) July 11 (elevation, 6,415.21 ft or 1,955.356 m); no storage on many days.

Period of record: Maximum daily contents, 9,250 acre-ft (11.4 hm³) July 4, 1967 (elevation, 6,418.52 ft or 1,956.365 m); no storage on many days each year.

REMARKS.--Reservoir is formed by concrete arch dam completed in 1960. Usable capacity, 17,170 acre-ft (21.2 hm³) between elevation 6,343.75 ft (1,933.575 m), invert of river outlet, and 6,441.00 ft (1,963.217 m), spillway crest, not including 68 acre-ft (83,800 m³) below elevation 6,343.75 ft (1,933.575 m). Prior to Oct. 1, 1971, usable capacity was 17,280 acre-ft (21.3 hm³) not including 149 acre-ft (184,000 m³) below the invert. Figures given herein represent usable contents. Water is used for irrigation of lands in Owl Creek basin.

COOPERATION.--Records furnished by Bureau of Reclamation.

Month	Water-surface elevation (feet)	Contents* (acre-feet)	Change in Contents (acre-feet)
September 30, 1974.	-	0	-
October 31.	-	0	-
November 30	-	0	-
December 31	-	0	-
January 31, 1975.	-	0	-
February 28	-	0	-
March 31.	-	0	-
April 30.	6,353.65	284	+284
May 31.	6,378.90	1,750	+1,466
June 30	6,402.60	5,160	+3,410
July 31	6,401.17	4,870	-290
August 31	6,345.00	10	-4,860
September 30, 1975.	-	0	-10
Water year 1974-75			0

*Does not include dead storage of 68 acre-feet (83,800 m³).

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

Bighorn Lake near St. Xavier, Montana

LOCATION.--Lat 45°18'27", long 107°57'26", in SW¼SE¼ sec.18, T.6 S., R.31 E., Big Horn County, in block 13 of Yellowtail Dam on Bighorn River, 1.3 mi (2.1 km) upstream from Grapevine Creek, 15.5 mi (24.9 km) southeast of St. Xavier, and at mile 81.0 (130.3 km).

DRAINAGE AREA.--19,626 mi² (50,831 km²).

PERIOD OF RECORD.--November 1965 to September 1975 (monthend contents only). Prior to October 1969, published as "Yellowtail Reservoir."

GAGE.--Water-stage recorder in powerhouse control room. Datum of gage is at mean sea level (levels by Bureau of Reclamation).

EXTREMES.--Current year: Maximum contents, 1,191,000 acre-ft (1.47 km³) July 26 (elevation, 3,646.81 ft or 1,111.548 m); minimum, 734,600 acre-ft (906 hm³) Mar. 31 (elevation, 3,597.13 ft or 1,096.405 m).

Period of record: Maximum contents, 1,346,000 acre-ft (1.66 km³) July 6, 1967 (elevation, 3,656.43 ft or 1,114.480 m); minimum since first filling, 660,700 acre (815 hm³) Mar. 11, 1970 (elevation, 3,584.45 ft or 1,092.540 m).

REMARKS.--Reservoir is formed by thin concrete-arch dam; construction began in 1961; completed in 1967. Storage began Nov. 3, 1965. Usable capacity, 1,356,000 acre-ft (1.67 km³) between elevation 3,296.50 ft (1,004.773 m), river outlet invert, and 3,657.00 ft (1,114.654 m), top of flood control. Elevation of spillway crest, 3,593.00 ft (1,095.146 m). Normal maximum operating level, 1,097,000 acre-ft (1.35 km³), elevation, 3,640.00 ft (1,109.472 m). Minimum operating level, 483,400 acre-ft (596 hm³), elevation, 3,547.00 ft (1,081.126 m). Dead storage, 18,970 acre-ft (23.4 hm³) below elevation 3,296.50 ft. (1,004.773 m). Figures given herein represent usable contents. Water is used for power production, flood control, irrigation, and recreation.

COOPERATION.--Elevations and capacity table furnished by Bureau of Reclamation.

Month	Water-surface elevation (feet)	Contents* (acre-feet)	Change in Contents (acre-feet)
September 30, 1974.	3,636.64	1,056,000	--
October 31.	3,634.01	1,026,000	-30,000
November 30	3,629.13	976,200	-49,800
December 31	3,621.62	909,200	-67,000
January 31, 1975.	3,611.10	826,500	-82,700
February 28	3,600.91	758,400	-68,100
March 31.	3,597.24	735,000	-23,400
April 30.	3,599.03	746,300	+11,300
May 31.	3,609.98	820,100	+73,800
June 30	3,627.02	956,400	+136,300
July 31	3,645.97	1,179,000	+222,600
August 31	3,637.08	1,061,000	-118,000
September 30, 1975.	3,633.19	1,018,000	-43,000
Water year 1974-75			-38,000

*Does not include dead storage of 18,970 acre-ft (23.4 hm³).

RESERVOIRS IN EXISTENCE ON JANUARY 1, 1950

The extent, if any, of the use of reservoirs in this category which may be subject to Compact allocations was not determined. As a matter of hydrologic interest the monthend contents in acre-feet of four reservoirs are given. The first three reservoirs are in the Bighorn River basin, Wyoming and data on contents were furnished by the U.S. Bureau of Reclamation. Tongue River Reservoir in Montana is operated under the supervision of the Water Resources Division of the Montana Department of Natural Resources and Conservation, which agency furnished operating data.

Contents in acre-feet

Month	<u>a/Bull Lake</u>	<u>b/Pilot Butte Reservoir</u>	<u>c/Buffalo Bill Reservoir</u>	<u>d/Tongue River Reservoir</u>
September 30, 1974	81,270	19,030	314,700	30,900
October 31	82,590	16,260	282,000	30,900
November 30.	83,170	15,190	281,900	32,040
December 31, 1974.	83,300	15,190	275,300	29,100
January 31, 1975	83,300	15,120	268,300	34,800
February 28.	83,350	15,050	260,200	36,800
March 31	83,100	14,990	252,500	49,580
April 30	77,890	22,700	227,200	44,400
May 31	78,500	27,410	202,700	38,900
June 30.	125,300	25,500	301,100	67,680
July 31.	150,000	19,550	430,700	48,240
August 31.	111,100	19,930	369,100	16,460
September 30, 1975	69,600	20,450	307,400	13,100
Change in Contents				
During water year.	-11,670	+1,420	-7,300	-17,800

a/ Usable contents, from revised capacity table effective Oct. 1, 1965. Dead storage is 722 acre-feet (890,000 m³).

b/ Usable contents. Dead storage is 5,360 acre-ft (6.61 hm³).

c/ Usable contents, from revised capacity table based on survey of 1959. Contents prior to October 1960 based on survey of 1941. Dead storage is negligible.

d/ Usable contents. Dead storage is 1,400 acre-ft (1.73 hm³). Contents based upon sedimentation surveys of October 1948.



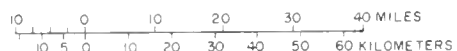
LOCATION MAP

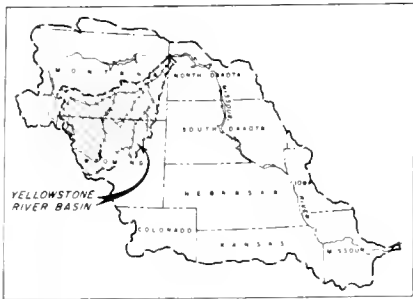


YELLOWSTONE RIVER COMPACT COMMISSION
YELLOWSTONE RIVER BASIN

EXPLANATION

- ▲ COMPACT STREAM GAGING STATIONS
- RESERVOIR CONTENT STATIONS





LOCATION MAP



